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Reevaluation of the Beef Carcass-to-Retail Weight Conversion Factor

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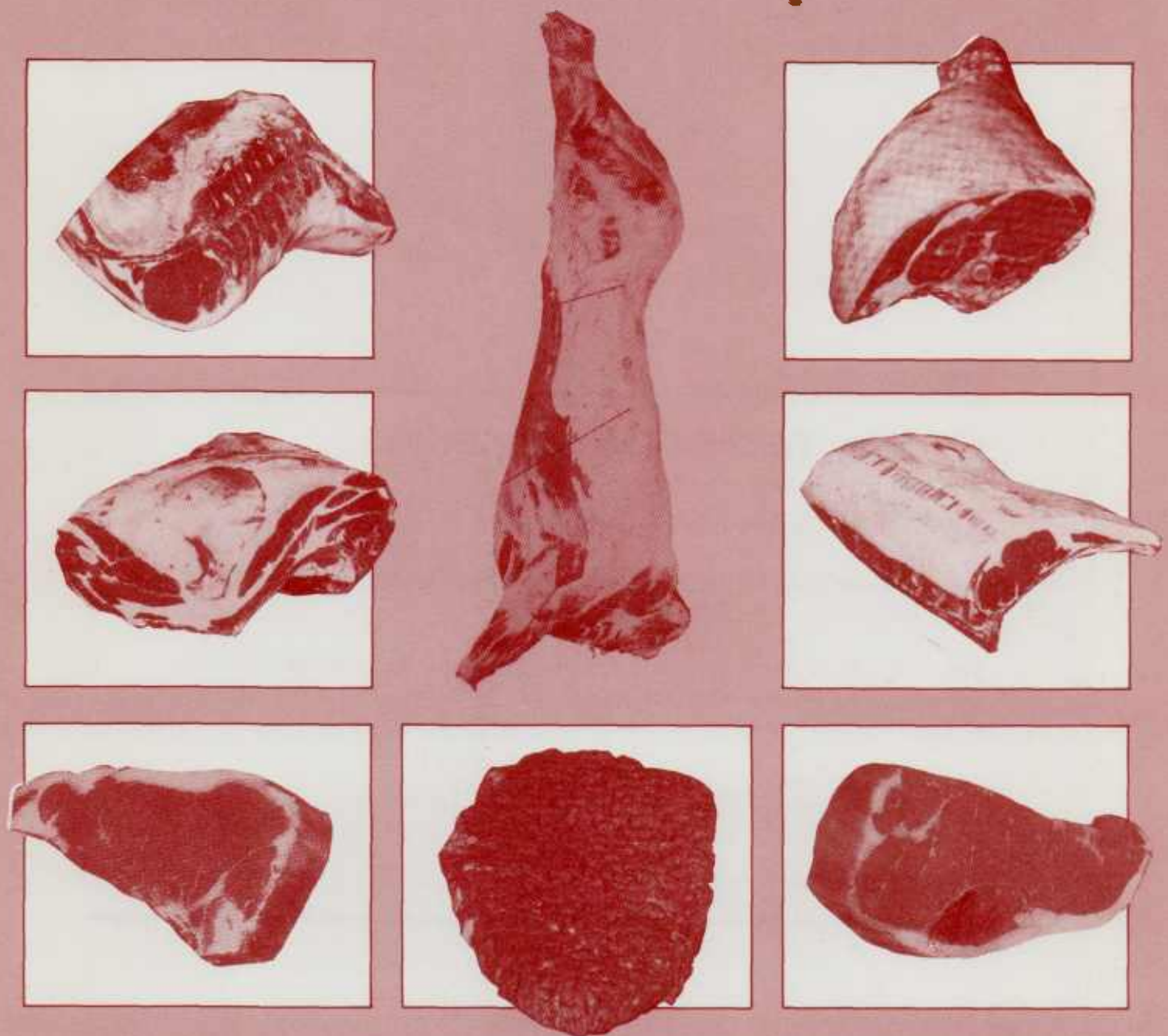

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Reevaluation of the Beef Carcass-to-Retail Weight Conversion Factor. By Kenneth E. Nelson, Lawrence A. Duewer, and Terry L. Crawford, Commodity Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 623.

Abstract

Reevaluation of the conversion factor used for changing beef carcass weight data to retail weight shows that the figure used since 1962 (0.74) was accurate through 1985. This report develops a new method for evaluating the conversion factor, and recommends that the factor be recalculated each year to account for changes such as leaner cattle, closer trimming of fat, and more removal of bone. Based on this new method, the conversion factor changed for 1986 (to 0.73), for 1987 (to 0.71), and for 1988 (to 0.705). The 1988 factor means that 70.5 percent of the original carcass is available for retailing. The conversion factor is the portion of the beef carcass purchased by consumers. The revised factor for 1988 represents about 3 1/2 pounds less beef per capita purchased than if 0.74 were still being used.

Keywords: Beef, beef disappearance, beef consumption, conversion factor, retail equivalent.

Preface

This analysis was completed under an agreement between the National Academy of Sciences (NAS) and the U.S. Department of Agriculture, Economic Research Service (ERS). NAS was interested in examining the conversion factor for accuracy. ERS publishes the retail equivalent series and is responsible for updating the conversion factor if required.

Acknowledgments

We appreciate the cooperation of many individuals and firms in our search for data and information to complete this study. Many of these contacts are listed in the references and appendix II. We thank Lorene Cooper and others who assisted in typing and preparing the manuscript. We also thank the reviewers of the report to NAS upon which this report is based: Karen Bunch, William Hahn, and John Romans.

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Summary

To determine how much of a beef carcass is processed into beef products suitable for sale in grocery stores, the U.S. Department of Agriculture updated the conversion factor in 1962 to change beef carcass weight data to retail weight equivalent. Reevaluation of this conversion factor shows that the figure used since 1962 (0.74) was accurate through 1985. The figure indicates that after fat, bone, and other trim have been removed from the carcass, 74 percent of it can be sold at retail. This report develops a new method for evaluating the conversion factor that accounts for different classes of cattle and adjusts for trends in beef merchandising.

Based on this new method, the conversion factor changed for 1986 (to 0.73), for 1987 (to 0.71), and for 1988 (to 0.705). The figure should be recalculated each year to account for changes such as leaner cattle, closer trimming of fat, and more removal of bone.

The conversion factor estimates the portion of the beef carcass purchased by consumers. The drop in the conversion factor for 1988 represents about 3 1/2 pounds less beef per capita purchased than if the data were calculated with the 0.74 conversion factor. The conversion factor change between 1987 and 1988 means about a half a pound less beef per capita was calculated as sold at retail.

Beef production and marketing have changed since the carcass-to-retail weight conversion factor was established in 1962. Beef production now emphasizes more commercial feedlots, larger and faster growing cattle, and leaner beef animals. Feeding practices have changed, and average slaughter weights are up. Meat packers and retailers now remove more fat and bone before retail sale. These trends prompted reassessment of the procedure used to calculate the carcass-to-retail conversion factor.

The U.S. Department of Agriculture applies the conversion factor to estimates of carcass weight data on beef disappearance (use or consumption) published in quarterly and annual supply and utilization tables. The retail weight equivalent information in these tables is the basis for other important data series.

Glossary

Boned out--Beef that has bones removed.

Boning--To remove all the bones from the beef carcass or primal cut.

Boxed beef--Beef cut into primals or subprimals; vacuum-packed, and placed in cartons by the packer.

Break--Reducing the carcass to primal cuts.

Cutout--Yield in percent of retail cuts that can be sold from a carcass. Amount of meat versus fat, bone, and waste.

Cattle cycle--Cattle production and price movements vary in a repetitive pattern. When prices (and profits) are cyclically low, cattlemen reduce their herds, and they increase cattle numbers when prices are favorable. Historically, cycles have been 10 years in length.

Consist--Used as a noun - the makeup or distribution of qualities or characteristics of a product in a given time period.

Fabricate--Cutting the carcass or primals to subprimals, Institutional Meat Purchase Specifications (IMPS), or smaller. May also include portion control cuts, dicing, and grinding.

Finish--How fat the animal is at a given point in time or at slaughter. The more finish, the fatter the animal.

Grain-fed cattle--Designation of slaughtered animals that were fed rations that were largely grain for an extended period before slaughter.

Grass-fed cattle--Designation of slaughtered animals that have been fed grass or roughage and little or no grain or concentrate. Produces leaner animals with less marbling.

Marbling--Quantity of fat interspersed within lean beef muscle. More marbling is usually associated with higher palatability.

No-Rolls--Ungraded steer and heifer beef. Some carcasses are not graded and others that are graded are not rolled or marked with the grade received. Most would be Select (formerly Good) grade.

Packers--Firms that slaughter or slaughter and process livestock or poultry.

Primals--Major cuts from a carcass: chuck, rib, loin, round, shank, brisket, short plate, and flank. The first four are major primals and the last four are sometimes referred to as rough cuts.

Prime, Choice, Select--USDA quality grade designations applied to qualifying young, grain-fed steers and heifers.

Quality grades for steer and heifer slaughter (Prime, Choice, Select, Standard, Commercial, Utility, Cutter, and Canner)--USDA grading system based on maturity of the animal, the amount of marbling, and other palatability characteristics.

Rolled--Beef that has been graded and marked (stamped) the length of the carcass with a dye indicating the quality grade received.

Side weight--Quantity in pounds of one-half the carcass (the carcass is cut in half from head to tail down the back into two "sides").

Subprimals--Smaller cuts from primals. A primal round may be cut into the following subprimals--top round, bottom round, and knuckle.

Utility, Cutter, and Canner--USDA quality grades that represent the lowest carcass grades. These grades are used mainly for cow beef but may also be applied to bull and stag beef. A few cuts may be sold from Utility grade animals, but most of this beef is boned and used for grinding and processing.

Vacuum-packed--The placing of a primal, subprimal, or cut in a multilayered plastic bag and removing the air by creating a vacuum to shrink the bag around the meat. This process reduces shrinkage and deterioration.

Yield grades (1-5)--USDA system of identifying cutability (lean yield) differences among beef carcasses. Yield grade 1 has the least fat and waste and yield grade 5 the most.

Reevaluation of the Beef Carcass-to-Retail Weight Conversion Factor

Kenneth E. Nelson
Lawrence A. Duewer
Terry L. Crawford*

Introduction

The beef carcass-to-retail conversion factor, an estimate of the portion of the beef carcass purchased by consumers, is used to calculate the U.S. beef retail weight equivalent data series published by the Economic Research Service (ERS), U.S. Department of Agriculture (USDA). This series is presented in supply and utilization tables published quarterly and annually. Other important series are also based on the retail weight series. Two significant examples are the money expenditures for beef series published by ERS and the nutrients available from beef series published by the Human Nutrition Information Service (HNIS).

The importance of the conversion factor and the many changes the beef industry has undergone since the factor was last reviewed in 1962 highlight the need for research to reevaluate the conversion factor. The National Academy of Sciences (NAS) and ERS performed this research cooperatively because of NAS' interest and responsibility in examining the technological options for nutritional improvements in the food supply and ERS' responsibility to provide the public with accurate data concerning the pounds of beef purchased by consumers.

The purpose of this cooperative research between NAS and ERS was to assess the applicability of the carcass-to-retail weight conversion factor for beef over time. The conversion factor 0.74 had been used from 1962 to 1985. U.S. beef production and marketing have changed dramatically in the intervening 23 years, warranting reevaluation of this factor. Changes include cross-breeding, adoption of boxed beef, increased industrialization in meatpacking, and the trend to selling more boneless and closely trimmed cuts.

The specific objectives of this research were to:

- Determine the "best" method of deriving the carcass-to-retail weight conversion factor for beef.
- Assemble the data required to derive the conversion factor.

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- Calculate past and current conversion factor estimates with the "best method."
- Compare conversion factors calculated with the new method and the old one.
- Recommend procedures for maintaining an accurate conversion factor in the future.

Use of Data on Beef Retail Weight

No source reports actual retail weight of beef sold, so ERS estimates this quantity. The beef carcass-to-retail conversion factor used by ERS to adjust for the removal of fat, bone, trim, and other loss between the weight of beef product in a hanging carcass and the weight purchased by a consumer was set at 0.74 in 1962. The factor indicates that from every composite carcass pound of beef produced, a consumer eventually buys about three-quarters of a pound (0.74) of product.

This conversion factor's function is to arithmetically transform one product form to another, in this case carcass pounds to retail equivalent pounds as purchased. We accept that the series measuring the pounds of beef carcasses slaughtered is accurate because it is calculated from packer reports of actual numbers and weights of cattle slaughtered.

Retail Weight as an Indicator of Beef Consumption

Some users of the retail weight series mistakenly believe that the retail weight series shows beef ingestion by consumers. The series is more accurately interpreted as the equivalent pounds purchased by consumers, assuming all beef is purchased from retail grocery stores. This estimate is not precise because the consumer may buy beef in a number of forms, for instance, cooked in a restaurant, in addition to fresh in a supermarket. Note especially that purchased pounds may not all be ingested because consumers may remove bone, fat, and other portions of the purchased meat during preparation or on their plate. (See appendix I.)

Need for Updating the Conversion Factor

ERS and NAS initiated this project to determine whether the 0.74 conversion factor used when this study began was still appropriate, and whether it should remain fixed for several years or be reestimated at regular intervals.

Several changes have occurred in beef production and marketing since 1962 that affect the conversion factor. Beef animals now grow faster and larger, more steers and heifers are fed grain, and large commercial cattle feedlots are more prevalent. Feeding practices and meat handling and merchandising practices have changed. Packers now break and fabricate more beef. Consumer concern about dietary fat and cholesterol has encouraged closer trimming of fat. Other factors such as increased average slaughter weights, changes in USDA grading standards, and fluctuations in the proportions of grass- versus grain-fattened cattle all indicated that the conversion factor may have changed. This study examines these facets of the conversion factor question.

Project Scope

All possible factors bearing on the past and current values of the beef conversion factor clearly could not be evaluated within the scope of this study. The scope was narrowed to include those factors expected to be both numerically important and researchable.

Variables Considered in Deriving the Conversion Factor

Many factors affect beef retail yield. Because cattle vary and customer needs differ, many varieties of meat items are available. Packers cut beef into varying sets of primals and subprimals, or packers and retailers leave varying amounts of fat cover or produce varying amounts of boneless cuts. Beef is mostly sold as cut-up, recently slaughtered fresh product, but restaurants cook beef in different portions for their customers. For these reasons, the only way to obtain a totally accurate value would be to keep track of every animal and every piece of meat sold in America, an obviously impractical procedure.

On average, heavier carcasses yield a lower percentage of lean beef because heavier animals usually have more fat to be trimmed off. However, a large-framed steer may weigh more than a lighter, genetically smaller steer; such larger steers may have a lower proportion of fat. Heifers normally weigh less at slaughter and are fatter at a given weight than steers. Cows and bulls yield differently than steers and heifers of the same weight. Two animals of the same weight may be of different age or different conformation and result in different cutting yields. Thus, although weight strongly influences cutout, weight alone will not provide an accurate prediction of yield. Fed versus nonfed is not a sufficient predictor because both length of time fed and the ration used can vary greatly. Similarly, the percentage of cows in the total number of animals slaughtered is useful, but by itself does not provide enough information.

We considered the following factors in this study:

- Yield differences among steers, heifers, cows, and bulls.
- Yield and weight differences for cattle that are not federally inspected.
- Closer trimming of beef fat and more removal of bone.
- Leaner hamburger and processed beef.

Limits of the Conversion Factor

Conversion factor definition also depends on what is to be measured. Some users want a series to reflect a constant equivalent product over time, for which the conversion factor should not change even if retailers decided to bone out more cuts. Other users are concerned only with what consumers actually purchase, in which case the conversion factor would change as merchandising methods change.

We assume that the goal of the retail weight series is to reflect the pounds of beef product for which consumers pay. If consumers pay for fat and bone, the series should include them. The retail weight series ideally would reflect the transaction quantity (amount purchased) for the transaction price (cost per unit). This information would facilitate expenditure estimates, economic demand analyses, and descriptive comparisons and trends.

Both the carcass and retail weight series include home produced and consumed beef as well as purchased beef. Home produced and consumed beef is less than 1 percent of the total and, although always included, is not always mentioned when consumption numbers are discussed. When consumption data are multiplied by price to estimate expenditures, the home raised quantity is assumed to be priced the same as the purchased beef. The carcass-to-retail conversion is also assumed the same for the home raised and consumed as for the commercially produced.

Currently available retail beef prices do not perfectly give the all-beef transaction price because Bureau of Labor Statistics (BLS) prices reflect beef prices for only some cuts sold in grocery stores. The transaction quantity is complicated because not all beef is bought in fresh form from grocery stores. Cooked beef from a restaurant or an institutional setting weighs less than fresh meat, and restaurant prices, if reported, would be complicated by the value of added services. As a result, the transaction quantities and transaction prices can only be reflected as retail store equivalent transaction quantities and prices. An all-beef quantity or price should reflect not only fresh Choice beef but also all grades and at least most beef uses (including sausage products like hot dogs and bologna). The conversion factor used must represent or reflect all these channels.

The goal of using the conversion factor is to reflect changes in cattle over time, the proportions of all types of cattle from old dairy cows to Prime steers as they change with the cattle cycle, and differences in handling and merchandising methods.

In the following section, we outline the general procedures and findings of our evaluation. Supporting detail and data are found in the appendixes.

Data Sources

Information and data needs of this project were large. Fat in meat is a popular topic, and new information is always available. In some cases, we were given data but cannot disclose the source because of confidentiality concerns. Much of the data used, however, is public information, most of which comes from various USDA agencies. Several Texas A&M University releases were also very useful. Discussions with knowledgeable people in the beef industry independently supported our results and added confidence to our recommendations. (See appendix II.)

Selecting the Method for Deriving the Conversion Factor

We examined three successively more complex procedures as options for deriving the conversion factor. We briefly discuss these procedures here; see appendixes III and IV for more detail.

Tallow Production Method

We considered a method based on tallow production, but rejected this process for deriving a conversion factor for beef. In 1977, the carcass-to-retail conversion factor for pork was changed based on the proportion of lard produced. We considered a similar approach for beef.

We compared tallow and bonemeal production data with total carcass weight of beef production. Total production less tallow and bonemeal (adjusted for processing) should provide an estimate of product sold as beef. The result was roughly consistent with a conversion factor of 0.74. However, unlike pork, which is the only source of lard, tallow is produced using fat from beef and other sources. A lack of data regarding specific sources and yields of tallow and bonemeal caused us to conclude that necessary assumptions were too tenuous and results too sensitive to these assumptions for the tallow method to be viable for computing the conversion factor for beef.

Simple Slaughter Distribution Method

This method accounts for variations in carcass-to-retail weight for different types of cattle, but it is inadequate for deriving an accurate conversion factor because it omits important merchandising trends. The method incorporates published or estimated production and yield coefficients by class of cattle slaughtered. We computed the average yield grade and the associated retail cutout for three slaughter groups: USDA graded steers and heifers; ungraded steers and heifers; and cows and bulls. Yield grades roughly indicate carcass-to-retail conversion for a particular carcass. We derived the overall conversion factor based on cattle slaughtered within a given yield grade. Yield grade 1 cattle, for example, have the least fat and waste. If more yield grade 1 cattle were slaughtered, the conversion factor would rise. We assumed fat trim thickness of approximately one-half inch on retail cuts.

The resulting estimated conversion factors are:

Year	Estimated conversion factor
1976	0.7265
1980	0.7125
1984	0.7403
1985	0.7412

Further analysis revealed that the difference in estimates between 1976-80 and 1984-85 could largely be attributed to anomalies in small sample data on the yield grades of ungraded steer and heifer beef. This method also failed to consider the known trend to more closely trimmed and more nearly boneless beef. For these reasons we considered the Simple Slaughter Distribution method superior to the tallow method but still inadequate to serve as a continuing basis for calculating the conversion factor for beef.

Experience with this method also convinced us that estimating different yield grades for cows and bulls was not fruitful because of lack of available data and absence of variation over time in yield grades for cows. Assuming a constant cutout for all cows and for all bulls and stags is judged sufficient.

Conversion Factor Adjusting Method

The "best" method for deriving the conversion factor uses the basic steps from the Simple Slaughter Distribution method, with the following changes:

- Average yield grades for ungraded steers and heifers were adjusted such that the yield grade relationship between graded and ungraded steers and heifers from small sample data was carried over to the universe. 1/ The effect of this change was to reduce the estimated yield grade for ungraded steers and heifers from that used in the Simple Slaughter Distribution method.

- Average yield grades were not estimated for cow and bull slaughter. Rather, retail cutout was held constant for all years at 0.733 for all cows and at 0.753 for all bulls and stags.

- We adjusted for meat merchandising changes. A highly publicized quarter inch trim promotion by retailers began in 1986. We assumed merchandisers trimmed beef fat closer and removed more bone in later years. The accumulated change in trimming prior to 1986 was small, at about 0.9 percent more fat and bone removed from the carcass in 1985 compared with 1975.

- We accounted for varying weight and yield of cattle that were not federally inspected. Nonfederally inspected steer and heifer slaughter was lighter and leaner than federally inspected slaughter. Most of our production data series cover federally inspected slaughter.

- We applied an adjustment based on the assumption that hamburger and processed beef have become leaner. We assumed that hamburger and processed beef contained 1 percentage point less fat in 1985 compared with 1975.

Findings

Our analysis indicated that 0.74 is a reasonable estimate of the carcass-to-retail weight conversion factor for beef for 1975 through 1985. We assume that 0.74, as set in 1962, is also a reasonable estimate for the 1962-75 period. We recommend that the Conversion Factor Adjusting method be used to test the conversion factor at the end of each year. We suggest the factor change in increments of no less than 0.005. The 1986 factor has been changed to 0.73, the 1987 factor to 0.71, and the 1988 factor to 0.705 because of the strong trend to closer fat trim in 1986 and later. The move to more boneless cuts also contributed to a decreased cutout (table 1).

Stability of the Conversion Factor Through 1985

The stability of the conversion factor for such a long period of time resulted from the coincidental counterbalancing of trends.

1/ Unpublished study by Agricultural Marketing Service (AMS), USDA, conducted as a check on accuracy of AMS graders. See appendix IV.

Yield grades have been gradually improving (more 2's and fewer 4's), which in the absence of other variables would increase the conversion factor because less fat needs to be trimmed. The trend to leaner yield grades happened at the same time that average weights increased, which normally means more fat. Larger cattle and cattle types carrying less fat are more common now.

Early in the 1962-85 period, feedlot feeding of cattle increased. More grain-fed cattle were produced relative to grass-fed cattle. This trend would tend to reduce the 0.74 conversion factor.

Offsetting the yield grade improvement has been a gradual trend to sales of more boneless cuts and cuts with more fat trimmed off. Ground beef now averages a slightly lower fat percentage. Taking out more fat and bone reduces the conversion factor, so that meat merchandising changes have balanced out the changes in cattle yield.

Changes in USDA beef grades in 1976 also offset the leaner cattle. Cattle with less finish were allowed to grade Choice, meaning that if the cattle were in fact marketed 2 or 3 weeks earlier, the slightly less finish or fat would tend to make the 0.74 conversion factor larger as the amount of fat to be trimmed off would decrease.

Cow and bull cutouts have stayed about the same because they are essentially all boned out and used in ground beef or processed meats. A few cow table cuts are exceptions. Because the overall cutout for cows is near 0.74, the

Table 1--Beef carcass-to-retail conversion factors using Conversion Factor Adjusting method

Year	Unadjusted weighted factors for--					Adjusted successively for--		
	Steers and heifers		Bulls and stags	Cows	All federally inspected cattle	Bone and fat removal	Non-federally inspected slaughter	Fat in processed beef
	Graded	Ungraded						
1975	0.7428	0.7367	0.7530	0.7330	0.7398	0.7398	0.7408	0.7408
1976	.7359	.7382	.7530	.7330	.7362	.7362	.7371	.7370
1977	.7390	.7393	.7530	.7330	.7384	.7383	.7390	.7388
1978	.7391	.7399	.7530	.7330	.7385	.7385	.7390	.7386
1979	.7376	.7407	.7530	.7330	.7380	.7378	.7384	.7378
1980	.7369	.7430	.7530	.7330	.7381	.7376	.7383	.7375
1981	.7383	.7409	.7530	.7330	.7385	.7375	.7381	.7371
1982	.7401	.7432	.7530	.7330	.7400	.7385	.7391	.7377
1983	.7420	.7441	.7530	.7330	.7413	.7389	.7394	.7376
1984	.7481	.7514	.7530	.7330	.7464	.7422	.7428	.7406
1985	.7471	.7511	.7530	.7330	.7461	.7387	.7393	.7366
1986	.7482	.7518	.7530	.7330	.7467	.7302	.7308	.7276
1987	.7479	.7516	.7530	.7330	.7469	.7249	.7253	.7108
1988	.7466	.7502	.7530	.7330	.7458	.7208	.7211	.7068

changes in the number and size of cows slaughtered during the cattle cycle did not significantly influence the conversion factor.

Revised Conversion Factors for 1986, 1987, and 1988

The trends to removing more fat from cuts and boning out more cuts were not offset in 1986, 1987, and 1988. We suggest that a conversion factor be calculated yearly using the Conversion Factor Adjusting method developed in this report, as was done for 1986-88, to see if the conversion factor changes in the future.

The conversion factor dropped in 1986 from 0.74 to 0.73. The largest factor in the change in the conversion factor was fat trim. Early in 1986, the two largest retail grocery chains announced they were going to leave a maximum of only one-quarter inch of outside fat. Closer trimming was part of the trend among consumers to reduce fat consumption. The decision to trim more at retail was impetus for closer trimming throughout the beef channel. Computation of the 1986 conversion factor using the Conversion Factor Adjusting method reflected this closer trim. More boneless cuts and less fat in sausage products were also factors in 1986. The estimated conversion factor for 1986 was 0.7276 (which rounds to 0.73).

Increased fat trim accounted for 2.3 percentage points of change in cutout between 1975 and 1986. More boneless cuts accounted for 1.1 percentage points of change in cutout between 1975 and 1986. We estimated that 60 percent of all steer and heifer beef was affected by these assumed fat and bone changes. The final adjustment to reflect the amount of fat in hamburger and sausage products was assumed to be a 0.0032 change in the conversion factor (from 0.7308 to 0.7276) (table 1).

The change in the conversion factor from 0.74 to 0.73 is small compared with the up to 10 percent difference in cutout that can occur between two carcasses. As an average, however, it is a large change because averages change slowly. The conversion factor did not change for 25 years and would be expected to change slowly.

The conversion factor fell again in 1987, to 0.71. The trends toward much closer fat trim, more boneless cuts, and sale of leaner ground beef continued during 1987. The Conversion Factor Adjusting method produced an estimated conversion factor of 0.71077, which was rounded to 0.71.

This represents a significant change from the 1986 factor of 0.73. This change in carcass weight consumption (disappearance) from 0.73 to 0.71 means a difference of 2.1 pounds of beef per capita for 1987. Lower fat content of meat sold at retail is the major reason for the drop in the conversion factor.

More fat is now trimmed off meat before retail sale. The Texas A&M University National Beef Market Basket Survey, taken in late 1987 and early 1988 in 12 cities across the United States, showed the magnitude of the change in fat trim. 2/ The change in the cutout for 1987 from 1975 assumed for this analysis reflected the greatly increased trimming of fat from retail cuts

2/ Savell, J.W., H.R. Cross, D.S. Hale, and Linda Beasley. National Beef Market Basket Survey. Meat research brief, Texas A&M Univ., College Station, TX, 1988.

before sale (2.6 percent). We assumed that the shift to boneless cuts changed 1.2 percent (from 1975) for a total shift of 3.8 percent in the cutout possible for steer and heifer beef. We also assumed that 70 percent of the steer and heifer beef would be affected by the new cutout assumptions.

We assumed that the percentage of fat in ground beef and processed beef purchased decreased 6 percentage points from 1975 to 1988, a drop from about 28 to 22 percent fat. Estimating the average percentage of fat is difficult, but data available indicate that a substantial drop (about 6 percentage points) has occurred. While graded and ungraded consist data, head and weight data, and other data were all used as variables in our procedure, the fat trim and fat percentage in processed meats were the big reasons for the conversion factor change.

For the 1988 estimate the change in cutout due to fat trim was increased to 2.7 percent and the shift to boneless cuts changed to 1.3 percent. The percentage of steer and heifer beef assumed affected was raised to 75 percent. The percentage of fat in ground and processed beef was not changed from 1987. The conversion factor for 1988 became 0.705 with these changes when the Conversion Factor Adjusting method was applied.

Conversion factors should be checked yearly or at least periodically to evaluate their relevance. The strong emphasis on removing more fat beginning in 1986 and the trend to more boneless cuts changed the 0.74 conversion factor to 0.73 for 1986, to 0.71 for 1987, and to 0.705 for 1988. Future years may see more conversion factor changes. Improvement in genetics, a grading change, or some other factors may eventually move the conversion factor back nearer the 0.74 range, but for now, the emphasis on trimming off the exterior fat has changed the factor to 0.705.

We recommend that the Conversion Factor Adjusting method be used each year. The nature of the data require that the procedure be applied as soon as possible after the completion of the year. We recommend changes only in 0.005 increments. If the recalculated factor is not more or less than 0.0025 of the current number used, we would continue using the current number. The data for the year tested would thus need to be revised if they in fact showed an adjustment was needed, as was the case for 1986, 1987, and 1988.

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Appendix I: Measuring Beef Consumption

The retail weight statistical series generated with the carcass-to-retail conversion factor can be used for research on beef consumption and expenditures. The following section examines some issues relating to accurately measuring beef consumption using data available from USDA.

Defining Beef Consumption

Consumption can have several meanings and each can be valid and satisfy a purpose. Twenty years ago, the per capita consumption of beef was usually quoted on a carcass weight basis as a little over 100 pounds. Most people today use the retail weight figure (the carcass weight adjusted by the conversion factor), which is less than 80 pounds. This switch from the carcass to retail weight equivalent basis probably happened because retail weight data more closely reflect the number of pounds consumers buy, thus facilitating computations on expenditures for beef.

Meat industry groups have pointed out that people do not eat carcass pounds or retail pounds but actually consume only "ingested" pounds. People do not ingest bones at all and possibly only a small proportion of the trimmable fat and liquids that come out when the beef is cooked. Several health concerns, including heart disease and cancer, have been identified, rightly or wrongly, with the consumption of high levels of meat (particularly fat). Most diet changes have proposed reducing, not eliminating, meat (including beef) consumption. Thus, actual ingested weight may be significantly less than retail weight owing partly to reduced consumption of fat in beef, but mainly because we have never eaten bone and much of the juices lost in cooking.

Retail Weight as an Indicator of Consumption

The controversy thus centers on what to call retail weight beef. Consumption, disappearance, edible weight, ingestion, and purchased weight are all terms that have been suggested. ERS has always tried to explain the term "consumption" by including the weight basis of its data. For example, per capita consumption of beef was 79.1 pounds on a retail weight basis in 1985. 3/ ERS will continue to publish data on a carcass and retail weight basis and to call attention to the fact that different weight bases can be used. ERS publishes an edible or boneless series in its "Food Consumption, Prices, and Expenditures" series.

Expenditures Measured with Consumption Data

The retail weight basis series is a significant series because prices are also available on a purchased pound basis. Thus, research on beef expenditures and other demand-related topics can be tied to the retail weight equivalent series.

A particularly important use of an accurate estimate of the pounds purchased at retail (retail weight consumption) is to combine it with the retail price to derive an estimate of expenditures. The accuracy of the expenditures estimate is a result of both the quantity and the price estimates. The quantity series has been criticized because it was based on the 0.74

3/ Putnam, Judith Jones. Food Consumption, Prices, and Expenditures, 1966-87. SB-773. U.S. Dept. Agr., Econ. Res. Serv., Jan. 1989.

conversion factor, which had been questioned as outdated. The price series was also criticized because the retail price used is for Choice beef only, instead of all beef.

This study should encourage people to trust the quantity series. An all fresh beef retail price was developed and released in 1988, so an expenditure series using either Choice or all beef price can now be calculated.

Supply and Utilization Tables

The carcass-to-retail conversion factor is one step in the general construction of the USDA supply and utilization tables for red meat. The supply and utilization tables are the first stage in calculating the consumption data series. We examined the construction of supply and utilization tables and the implications of the revised conversion factor. The carcass-to-retail conversion factor affects only the data produced in the last column of the supply and utilization tables, called per capita retail weight.

The USDA beef supply and utilization tables calculate the total beef disappearance used for carcass weight apparent consumption. This value is multiplied by the conversion factor to produce the retail weight series. The tables add U.S. beef commercial production, farm production, beginning stocks, and imports, and then subtract exports, ending stocks, and shipments to get total beef disappearance (appendix table 1).

The supply and utilization table figures for exports, imports, and most other numbers have been converted to a carcass weight basis entry. However, the table used beginning and ending stocks as product weight rather than carcass weight until recently. This inconsistency has now been corrected for both current and historical data. Military consumption data also were handled differently prior to February 1988.

Different categories of meat in the supply and utilization tables have different conversion factors. The USDA Economics, Statistics, and Cooperatives Service (ESCS) Statistical Bulletin 616 presents conversion factors for adjusting product weight of imported products to carcass weight. 4/ The same bulletin gives conversion factors for exports and for cold storage stocks. For boneless beef, the conversion rate for imports (nonfed beef) is 1.36 and for exports (fed beef) is 1.43.

Two cold storage categories for beef are boneless beef and beef cuts. The cold storage stocks are usually cow beef or trimmings for the boneless beef and fed cattle for the beef cuts.

Cold storage stocks are now converted to a carcass weight basis before they are entered into the supply and utilization table. The boneless beef conversion used is 1.36. For cuts we use 1.0 even though not all cuts are bone-in.

There are fewer pounds of beef cut stocks than boneless stocks, and beef cut stocks are decreasing over time. Cuts now represent a little more than 10

4/ U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service. Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products. SB-616. Mar. 1978.

percent of all beef cold storage stocks. The inventory of stocks varies seasonally but is usually only 1 to 2 percent of total disappearance. The conversion of the stocks data to a carcass weight basis adds more credibility to the use of the conversion factor to go from carcass to retail weight.

A conversion factor is felt only on the difference between beginning and ending stocks. From year to year, the stock inventory has changed less than 100 million pounds since 1978, so the stocks conversion factor has not had much effect on the supply and utilization data.

When we converted product weight (actually many different beef products) to carcass weight, we first thought that we should reverse the conversion factors when we wanted to convert the total disappearance in carcass weight to retail

Appendix table 1--Construction of supply and utilization tables for red meat

Item	Data source	Original units	Conversion source
Commercial production	NASS 1/	Carcass	NA
+ Farm production	NASS	Carcass	NA
+ Beginning stocks	NASS	Product	NA
+ Imports	DOC 2/	Product	B616 3/
= Total supply	Calc. 4/	NA	NA
- Exports	DOC	Product	B616
- Shipments	DOC	Product	B616
- Ending stocks	NASS	Product	NA
= Total disappearance	Calc.	NA	NA
/ Total population	DOC	NA	NA
= Carcass weight per capita disappearance	Calc.	NA	NA
* (Carcass to retail conversion factor)	B616	NA	B616
= Retail weight per capita disappearance	Calc.	NA	NA

NA = Not Applicable.

1/ NASS = National Agricultural Statistics Service.
2/ DOC = Department of Commerce.
3/ B616 = USDA, ESCS, 1978.
4/ Calc. = Calculated.

weight. But, some of those products denominated in product weight may not have been retail weight equivalent and may need trimming, boning out, or other work, and the sum of the imported products may not be in carcass proportion. Thus the carcass weight of the product may have a different conversion factor than the inverse of the change from product to carcass weight. In addition, the true conversion factor may be different from the one used historically (0.74) to convert beef production carcass weight in the United States to retail weight.

Appendix II: Individuals Providing Information

Listing of an individual's name does not imply that person's agreement or disagreement with this report nor does it mean that each individual's contribution was equal. We contacted each person by phone or in person and obtained information used in the study. We regret any oversights in this list.

Herb Abraham, USDA-AMS
Rich Besta, SIPCO (Packer)
Burdette Breidenstein, National Livestock & Meat Board
Karen Bunch, USDA-ERS
Charles Drumheller, Kroger (Retailer)
Keith Fairbanks, Fairbanks Farms (Packer)
Paul Fuller, USDA-AMS
John Ginzel, USDA-ERS
David Griffin, Texas A&M Univ.
Lou Havrilla, Iowa Beef Processors (IBP) (Packer)
Hilary Hodding, American Meat Institute (AMI) (Packer Org.)
Jim Hodges, AMI (Packer Org.)
Mike Hogye, USDA-AMS
Mitch Holland, Kroger (Retailer)
Roger Hoskin, USDA-ERS
Frank Lutz, Safeway (Retailer)
Tom Malcolm, Tama Meatpacking (Packer)
Mike May, USDA-AMS
Kevin McCullough (Consultant)
Ken Monfort, Monfort (Packer)
Mark Milsson, Safeway (Retailer)
Bill Parker, Kroger (Retailer)
Nancy Raper, USDA-HNIS
Jim Ray, USDA-AMS
Bob Rizek, USDA-HNIS
George Spencer, IBP (Packer)
Everett Stoddard, USDA-Packers and Stockyards Admin. (P&SA)
Pat Valdez, USDA-AMS
John Van Dyke, USDA-AMS
George Wilson, AMI (Packer Org.)
Jim Wise, USDA-AMS
Members of AMI Beef Committee, Omaha, Nebraska, April 14, 1986.

Note: Use of brand or firm names in this publication does not imply endorsement by the USDA.

Appendix III: Selecting the Method for Deriving the Conversion Factor

The following section contains details of the three options we considered for reevaluating the carcass-to-retail weight conversion factor. After examining a method based on quantity of tallow produced and a simple method based on different types of cattle, we concluded that the Conversion Factor Adjusting method is the best option for making periodic reevaluations of the factor.

Tallow Production Method

This method produced a result close to the old conversion factor, but the method left too many unanswered questions to be a satisfactory procedure.

The carcass-to-retail conversion factor for pork is found by measuring the amount of fat processed to lard. We examined the possibility of using a similar fat-to-tallow (or compounds containing animal fat) method for beef.

The fat, bone, and trim material rendered to obtain edible and inedible tallow also yields bonemeal. We assumed that the yield is 65 percent tallow and 35 percent bonemeal, and that 60 percent of all edible and inedible tallow comes from beef. 5/ For 1983 4.4 billion pounds of tallow and 2.3 billion pounds of protein meal were produced. These add to 6.7 billion pounds, which, if divided by 25 billion pounds of carcass beef production, give a ratio of 0.268. One minus 0.268 is 0.732, the conversion factor derived using the tallow method. Note that 0.732 is near the 0.74 figure now in use. We used this procedure to estimate the conversion factor for 1973, and the result was 0.774.

Our confidence in this procedure was low because we could not adequately account for several questions: Doesn't part of the tallow and protein meal production come from the offal and other noncarcass parts of the beef animal? Is some of the grease production beef? How does or should restaurant grease enter into these calculations? These questions, along with industry changes affecting usage of beef fat, like the shift to boxed beef (and thus more fat trimmed off sooner in the beef channel), encouraged us to seek other means of developing the carcass-to-retail conversion factor.

Simple Slaughter Distribution Method

This method is relatively simple and incorporates some direct assumptions as well as coefficients based on scant data. No strong conclusions should be drawn from it, but it illustrates procedures and suggests some benchmarks.

We made calculations for the years 1976, 1980, 1984, and 1985. We:

1.) Separated commercial steer and heifer slaughter (number) into graded and ungraded portions using the proportion of steer and heifer production (pounds) officially graded. (Assumed 60 percent graded, 40 percent not graded in 1976 and 1980. This method was examined before we had used AMS data to calculate the percentages of graded and ungraded beef used later.)

2.) Used total cow and bull slaughter as number of cows.

3.) Used the breakdown of steer and heifer production graded by yield grade (appendix table 2) to distribute graded steer and heifer slaughter among yield grades.

4.) Used the (very small) breakdown of cow production graded (appendix table 2) by yield grade to distribute all cow slaughter among yield grades.

5.) Used the unpublished small sample data collected by AMS to distribute ungraded steers and heifers among yield grades (appendix IV).

5/ Development Planning and Research Associates, Inc., and Schnittker Associates, Inc., "United States Production, Consumption, Trade and Stocks of Tallow/Grease Lard, and Animal Protein Meals, Estimates and Projections," unpublished contract study for U.S. Department of Agriculture, Foreign Agricultural Service, April 1980.

Appendix table 2--Percentage of carcass weight of officially graded beef by yield grade, 1975-87

Year	Classes included	Yield grade					Percent graded 1/	Weighted average yield grade
		1	2	3	4	5		
		Percent						Grade (assumes midpoint)
1975 2/	Steers, heifers, and cows	1.7	31.1	63.6	3.3	0.3	55.1	3.2
1976 3/	Steers and heifers	1.5	27.5	59.3	10.1	1.6	75.6	3.3
	Cows	11.0	52.1	29.5	6.0	1.4	NA	2.8
	Steers, heifers, and cows	1.8	28.3	58.3	10.0	1.6	55.9	3.3
1977	Steers and heifers	2.2	30.3	58.0	8.4	1.1	73.2	3.3
	Cows	11.4	51.8	29.6	6.0	1.2	NA	2.8
	Steers, heifers, and cows	2.4	30.9	57.3	8.3	1.1	NA	3.2
1978	Steers and heifers	2.0	30.1	58.8	8.1	1.0	73.1	3.3
	Cows	13.5	51.0	29.3	5.1	1.1	NA	2.8
	Steers, heifers, and cows	2.2	30.4	58.4	8.1	.9	56.1	3.3
1979	Steers and heifers	NA	NA	NA	NA	NA	70.8	NA
	Steers, heifers, and cows	1.8	29.0	58.7	9.3	1.2	57.6	3.3
1980	Steers and heifers	1.6	28.7	58.5	9.8	1.4	71.8	3.3
	Cows	12.5	49.6	33.1	3.4	1.4	NA	2.8
	Steers, heifers, and cows	1.6	28.9	58.4	9.7	1.4	56.1	3.3
1981	Seers and heifers	1.9	30.3	57.2	9.4	1.2	69.2	3.3
	Steers, heifers, and cows	NA	NA	NA	NA	NA	54.6	NA
1982	Steers, heifers, and cows	NA	NA	NA	NA	NA	NA	NA
1983	Steers and heifers	2.2	34.7	55.2	7.1	.8	67.6	3.2
	Cows	7.7	54.0	35.3	2.6	.4	NA	2.8
	Steers, heifers, and cows	2.3	34.8	55.1	7.1	.8	54.7	3.2
1984	Steers and heifers	3.5	42.0	49.5	4.7	.3	65.1	3.0
	Cows	8.8	62.2	27.2	1.6	.2	1.3	2.7
	Steers, heifers, and cows	3.5	42.1	49.3	4.7	.3	53.3	3.1
1985	Steers and heifers	3.6	40.6	50.1	5.2	.5	68.5	3.1
	Cows	9.1	58.5	29.3	2.7	.5	1.3	2.8
	Steers, heifers, and cows	3.6	40.7	50.0	5.2	.5	57.6	3.1
1986	Steers and heifers	3.9	41.7	49.0	4.8	.4	67.5	3.1
	Cows	6.9	62.7	28.6	1.6	.2	.6	2.8
	Steers, heifers, and cows	4.0	41.8	49.0	4.8	.4	56.1	3.1

See footnotes at end of table.

--Continued

Appendix table 2--Percentage of carcass weight of officially graded beef by yield grade, 1975-87 (Continued)

Year	Classes included	Yield grade					Percent graded 1/	Weighted average yield grade
		1	2	3	4	5		Grade (assumes midpoint)
		Percent						
1987	Steers and heifers	3.7	41.6	49.4	4.9	.4	64.3	3.1
	Cows	4.8	53.0	38.4	3.6	.2	.5	2.9
	Steers, heifers, and cows	3.7	41.6	49.4	4.9	.4	54.0	3.1
1988	Steers and heifers	3.6	40.2	49.9	5.7	.6	66.0	3.1
	Cows	5.0	58.0	32.5	3.3	.4	.4	2.8
	Steers, heifers, and cows	3.6	40.2	49.9	5.7	.6	56.4	3.1

NA = Not available.

1/ Steers and heifers are percent of Federally Inspected (FI) production. Others are percent of commercial production through 1980 and percent of FI production 1981 and later.

2/ Excludes beef quality-graded but not yield-graded in 1975.

3/ Includes beef that was yield-graded even if not quality-graded during the period 1/1/76 to 2/23/76. After February 1976, beef graded for either quality or yield is graded for both.

Source: USDA, AMS, Livestock and Seed Division, Meat Grading and Certification Branch.

6.) Used USDA-predicted salable retail product (which includes some bone and about one-half inch of fat trim) to assign retail product to steers and heifers by yield grade (appendix table 3).

7.) Reduced the USDA retail product from appendix table 3 by 3 percent in each yield grade for cows and bulls. We made this assumption because cow beef is often completely boneless.

8.) Calculated the weighted average retail product percent.

The calculated conversion factors resulting from this exercise are:

1976	0.7265
1980	0.7125
1984	0.7403
1985	0.7412

The computed conversion factors for 1984 and 1985 are remarkably close to the 0.74 conversion factor. This agreement does not necessarily confirm the current factor because the procedure demonstrated here implicitly assumes that the level of fat and bone removal is constant over time (whereas we believe fat and bone removal is increasing) and still shows an economically significant deviation

Appendix table 3--USDA standards for retail cut yield for Choice beef

Component	Midpoint of yield grade				
	1	2	3	4	5
	Percent				
Total salable retail cuts 1/	82.0	77.4	72.8	68.2	63.6
Fat	7.6	12.7	17.8	22.9	28.0
Bone	10.4	9.9	9.4	8.9	8.4
Total	100.0	100.0	100.0	100.0	100.0

1/ Some bone remains in salable retail cuts and trim level is presumed to be about one-half inch maximum of outside fat remaining.

Source: USDA, ESCS, Mar. 1978.

among years. This procedure appears to be too simple to reflect apparent industry trends.

Conversion Factor Adjusting Method

The Conversion Factor Adjusting method yielded a satisfactory estimate of the conversion factor, and is recommended for use to reevaluate the factor in the future. This procedure covers the most important variables affecting the size of the carcass-to-retail weight conversion factor, yet is not so detailed that the purpose is lost. While a short computer program was used to calculate the 14 years of results presented, the calculations for a new year could easily be done by hand. Calculations back to 1962 could not be made because some data were unavailable (ungraded before 1980, and yield-graded before 1976). However, some subjective estimates were made back to 1975.

Steps in the procedure are as follows:

1.) This first step is an assertion or assumption. Use the standard retail cut yields by yield grade published by AMS. The final retail cuts have no more than one-half inch maximum of outside fat and 3 to 4 percent bone remaining (appendix table 3).

2.) Use the percentage of the total pounds of all steers and heifers graded that fell in each yield grade (appendix table 2). The percentage of all federally inspected (FI) steer and heifer slaughter that is graded is also present (and used in this procedure). These data are on a weight, not per head, basis.

3.) Use the special survey which AMS uses to check the accuracy of graders to develop a consist of ungraded beef. The graded/ungraded relationship found in this AMS survey is applied to the consist of the steers and heifers graded to derive an estimate of the consist of ungraded steers and heifers. This required some subjectivity, but no other data are available (appendix table 4).

4.) Divide the total FI steer and heifer slaughter in carcass pounds (number of head times average carcass weight) into graded and ungraded by using the percentage by weight of steers and heifers actually graded (appendix table 2).

5.) Use the graded and ungraded portions from step 4 with the graded and ungraded consists from steps 2 and 3. The cutout factors applied for each yield-grade category are the standard cutouts from step 1.

6.) Assume cows to yield 73.3 percent of trimmed boneless meat and bulls and stags 75.3 percent. (See appendix IV for an explanation of these assumed cutouts.)

7.) Multiply the yields in step 6 by number of head times the average weights of cows and of bulls and stags.

8.) Combine totals from steps 5 and 7, and divide this by the total pounds to obtain the first overall preliminary estimate of the conversion factor. This estimate does not yet reflect any change in merchandising trends nor any effect of nonfederally inspected cattle slaughter.

9.) Adjust the steer and heifer contribution to the estimate of the conversion factor to reflect the trend to the merchandising of more boneless cuts and the trend toward removing more exterior fat from retail cuts. This adjustment is to step 5 above.

10.) Combine data as in step 8 except that steps 9 and 7 are now combined and divided by the total pounds to obtain a conversion factor adjusted for fat and bone.

11.) Adjust results further from step 10 to reflect the lighter (and leaner) animals slaughtered outside of Federal inspection. These include the "other" (cattle slaughtered under State inspection) added to FI to get commercial slaughter and farm slaughter.

12.) Finally, an adjustment was made to reflect the gradual trend toward purchases of ground beef and processed products with lower fat content. The adjustments in appendix IV, Fat in Ground and Processed Beef, were used to adjust the conversion factor downward.

Appendix IV: Yield Estimations

The Simple Slaughter Distribution and the Conversion Factor Adjusting methods for deriving the conversion factor use estimates of yield for various types of cattle. Details on the estimates used appear in the following sections.

Graded Beef

AMS records the pounds of beef officially graded, broken down by quality and yield grades. Information available differs from year to year (appendix table 2). There has been a slow shift toward yield grade 1 (more lean meat relative to fat). The proportion of 2's is increasing and 4's decreasing. The weighted average yield grade has fallen most since 1980. The 1975 figure is not completely comparable as beef could be either yield-graded or quality-graded independently before February 1976.

Appendix table 4--Weighted average yield grades of graded and ungraded steers and heifers, 1975-87 1/, 2/

Year	Graded 3/	Ungraded 4/
	Yield grade	
1975	3.2	3.31
1976	3.3	3.28
1977	3.3	3.25
1978	3.3	3.24
1979	3.3	3.22
1980	3.3	3.17
1981	3.3	3.22
1982	3.2	3.19
1983	3.2	3.15
1984	3.0	2.99
1985	3.1	3.00
1986	3.1	2.98
1987	3.1	2.99
1988	3.1	3.02

1/ Assumes midpoints for grades, for example, yield grade 3 equals 3.5.
2/ All cattle graded (for either quality or yield) before February 23, 1976, did not have to also be graded with the other (yield grade or quality grade). Both quality and yield grades were required until April 9, 1989, when quality and yield grades were once again allowed separately.
3/ From appendix table 2.
4/ Estimated from AMS small sample data after adjustment. The adjustment was made to maintain the relative values of the small sample averages but to use the published graded data as the base.

Source: USDA, AMS, Livestock and Seed Division, Meat Grading and Certification Branch; estimates derived by the authors.

These figures cover beef that was actually rolled (marked with the quality and yield grade). Graders may actually grade more beef than is recorded as graded in some instances. A packer may ask a grader to mark as graded only those animals that are found to be Choice yield grade 3 or better. This means the carcasses not marked were actually graded and found not to meet the roll guideline.

The amount of beef graded has stayed about the same over the years, but the U.S. population has increased and the percentage of beef federally inspected (FI) has increased. The percentage of steer and heifer beef slaughtered under FI has dropped over time. The uncoupling of quality and yield grades in 1989 may alter this trend.

The move to leaner beef production during recent years and the apparent consumer desire for leaner beef have meant the development of generic or store brand beef. Store brands are normally ungraded (no-roll) beef.

AMS Data on Yield Grades of Ungraded Beef

Data on graded beef alone are insufficient for this study, so estimates of the yield grade distribution of ungraded beef were sought. Meat is graded by the Agricultural Marketing Service (AMS) at the request of the packer, who pays for this service. All beef crossing State lines must be federally inspected; this is a free service to packers. Although USDA beef grades have specific attributes and standards for each quality and yield grade, the process of grading is not exact. Grading is usually done quickly without making specific measurements and involves some subjectivity.

To assure that all AMS graders grade consistently, AMS carries out a test regrading system where graders compare their opinions of the grades with the official grades marked. In this test program, all beef in the cooler, graded and ungraded, is compared. On this small-sample basis, AMS collects data on the grades of ungraded cattle.

AMS allowed these data to be used in making yield grade estimates of steer and heifer beef not officially graded. AMS does its test program only in plants where at least some cattle are graded, so a portion of the steer and heifer population may not be included. We found that ungraded cattle usually have a slightly smaller average grade (closer to yield grade 1) than the graded cattle. This is reflected in appendix table 4, where the average yield grades for graded and ungraded steers and heifers are recorded.

ARS Clay Center Data on Beef Cutout by Grade

The Agricultural Research Service (ARS) research facility at Clay Center, Nebraska, measures and records data on beef grades and cutouts. Appendix table 5 lists the cutting yields obtained with fat trimmed within a maximum of 0.3 inch, all bone removed, and the trim used for ground beef adjusted to a maximum of 25 percent fat. The retail product obtained as a percentage of side weight is listed in this table. The Choice yield grades 2 and 3 results are 68.4 percent and 64.0 percent, respectively. The difference between these and the 0.74 conversion factor is mainly bone and fat trim. The 0.74 conversion factor also reflects an average of all cattle and all trim used in ground beef and processed meat. The conversion factor is not limited to a fixed percentage because lean cow, bull, or imported beef can be combined with it before sale.

USDA Yield Grade Standards

The first and still-applicable official yield grade standards date back to June 1965 (appendix table 3). Until February 23, 1976, yield-grading beef was optional. Packers could have their beef quality-graded or yield-graded, quality- and yield-graded, or not graded at all. From 1976 until April 9, 1989, packers had to have beef both quality- and yield-graded if they chose to have it graded. On April 9, 1989, grading was again uncoupled (back to pre-1976 rules). They could always choose not to grade.

Appendix table 5--Retail product as percentage of side weight 1/

Yield grade	Standard	Good	Choice	Prime
		Percent		
1	77.8	74.1	72.2	NA
2	73.4	71.0	68.4	62.1
3	67.0	66.3	64.0	62.1
4	NA	60.5	59.8	59.2
5	NA	NA	56.0	58.1

NA = Not available.

1/ Trimmed to a level of 0.3 inch outside fat, boned out completely, with trim adjusted to 25 percent fat.

Source: Computed from data provided by R. M. Koch, USDA, ARS, Meat Animal Research Center, Clay Center, Nebraska.

The standards and the standard cut yield table have remained the same since yield-grading began. Texas A&M University and AMS conducted a study in 1974 to examine if the standard yield grade table needed to be revised. They found the table to be accurate. Yield grades have thus been the same over time and are also reported to be the same for different quality grades.

Selecting a Yield Grade Standard

Each beef carcass can be cut in a variety of ways, leaving different amounts of fat or bone. We had to select one standard measurement of carcass yield to begin our analysis. The USDA standard yield grades were used for our starting point. We then adjusted the yield grade standard in succeeding steps of the procedure to account for actual changes in packing and retailing practices.

The original cutting test by AMS (Murphey and others, 1965) used as the official USDA yield grade standard has withstood the test of time. AMS, in a study with Texas A&M University, examined and updated the official yield grade standards. The study decided that the official standards adopted in 1965 were accurate, especially for differences among yield grades.

These official AMS yield grade standards were adopted in the procedures of the Conversion Factor Adjusting method, recognizing their conditions--removal of about two-thirds of the bone and cuts trimmed of fat in excess of one-half inch. From these standards, adjustments can be made as needed.

Adjusting for Carcass Weight Differences

As a beef animal gets heavier, its fat content increases and its yield of retail product as a percentage of the carcass decreases. Thus, for a given universe of cattle, as carcass weights increase, we assume that the yield

grade average would get larger (move toward 5) and the retail yield would decrease. In addition, for a short time, we could also assume the yields would decrease as carcass weight increased.

Over a longer period of time, however, other factors are involved. Carcass weights have increased at the same time that average yield grades have improved (averaged closer to 1). (See appendix tables 4 and 6.)

Adjusting for Fat and Bone Removal

The conversion factor that adjusts carcass weight to the weight of product sold at retail is affected by the thickness of fat cover and the amount of bone left on meat sold at retail. The Conversion Factor Adjusting method of computing the carcass-to-retail conversion factor includes an adjustment in fat trim and boning out of cuts (appendix table 7). The assumed values are based upon industry observation and information but are subjective.

Health concerns have been a major factor affecting fat trim. Fat trim was not considered influential before 1979-80, but by 1986 concerns about fat increased dramatically. Many retail stores now reduce the fat left on meat to one-quarter inch, and some remove all trimmable fat. Cutout decreased by 2 percent in 1985 due to more trimming away of fat. The drop in cutout reflects the amount of additional fat trim below the one-half inch maximum fat left in the official AMS yield grade cutouts.

Appendix table 6--Average carcass weight of cattle slaughtered under Federal inspection, by class, 1975-88

Year	Steers	Heifers	Cows	Bulls and stags
		Pounds		
1975	673	556	475	689
1976	695	580	487	692
1977	684	579	473	689
1978	684	585	489	723
1979	699	598	519	741
1980	708	605	512	750
1981	709	609	512	752
1982	697	603	508	751
1983	703	611	507	750
1984	700	615	495	763
1985	726	641	509	778
1986	715	637	519	800
1987	717	648	529	810
1988	728	657	538	835

Source: USDA, National Agricultural Statistics Service.

Appendix table 7--Estimates of fat and bone adjustments and the percentage of steer and heifer beef affected

Year	Change in cutout assumed as a result of increased fat trim	Change in cutout assumed as a result of changes to more boneless cuts	Percentage of steer and heifer beef affected	Final adjustment
		Percent		
1975	0	0	0	0
1976	0	.1	1	.001
1977	0	.2	2	.004
1978	0	.3	3	.009
1979	.2	.4	5	.030
1980	.4	.5	7	.063
1981	.6	.6	10	.120
1982	.8	.7	13	.195
1983	1.0	.8	17	.306
1984	1.5	.9	22	.528
1985	2.0	1.0	30	.900
1986	2.3	1.1	60	2.040
1987	2.6	1.2	70	2.660
1988	2.7	1.3	75	3.000

Source: Authors' estimates.

The bone change assumes there has been a gradual change by retailers to boning out more cuts. The effect in 1985 of the stores boning out at least some cuts is assumed to be a 1-percent change in yield.

The third column in appendix table 7 addresses the concept of what percentages of all steer and heifer slaughter (graded and ungraded) were trimmed of fat or had bones removed at the level in the other two columns. Less trimming or boning took place in earlier years. Data for 1986, 1987, and 1988 show a large final adjustment resulting from changes in meat merchandising.

AMS Wholesale Cut Data

In order to estimate a composite of all cuts in a carcass, the percentage of each cut must be estimated. The Market News branch of AMS publishes an estimated boxed beef (subprimal) cutout value for Choice carcasses weighing 550-700 pounds, Choice carcasses weighing 700-850 pounds, and 550-pound and up Select (Good) carcasses. The cutout value varies for these three kinds of carcasses in relation to the size (and thus price) and grade of the wholesale cuts obtained from the carcass.

The percentages of each wholesale cut of all the meat in the carcass are of primary interest. These percentages are presented in appendix tables 8 and 9. The wholesale Institutional Meat Purchase Specifications (IMPS) cuts and

Appendix table 8--Breakdown of Choice, yield grade 2-3 carcass to boneless, closely trimmed retail product

Institutional Meat Purchase Specification wholesale cuts	Wholesale cut as percentage of carcass (one-half to one inch fat trim) 1/	Boneless retail product as percentage of wholesale cut (one-fourth inch fat trim) 2/	
	Percent		
112A Ribeye, lip on 2 inch	3.39	96.96	
120 Brisket, boneless, deckle off	2.73	82.44	
126 Armbone chuck boneless	23.73	82.35	
167 Knuckle	2.87	92.03	
168 Top (inside) round	5.82	85.86	
170 Bottom (gooseneck) round	7.26	84.10	
180 Strip, loin, shortcut, boneless	3.91	76.17	
184 Top sirloin, butt	3.39	87.65	
185A Sirloin flap	.49	99.42	
185B Sirloin ball tip	.54	97.74	
185C Sirloin tri tip	.69	91.08	
189 Full tenderloin	2.04	82.44	
193 Flank steak	.45	99.47	
Minor cuts:			
Outside skirt	.47	93.81	
Inside skirt	.44	74.34	
50/50 trim	12.67	98.11	
Other cuts	6.51	87.49	
Total	77.40	87.10	(weighted average)

Boneless retail product with 1/4-inch trim as percentage of carcass = 77.4 percent x 87.10 percent = 67.4 percent.

1/ Agricultural Marketing Service-published data, revised Jan. 1, 1988.
2/ Based on unpublished data from a major meatpacking company.

minor products reflect what packers have been selling (at least until recently, when some began trimming a portion of their product more closely). AMS worked with the industry and obtained general approval of these weights in January 1986. This cutout reflects IMPS standards: fat trim of 1 inch or less, boneless cuts.

These fabricated subprimal cutout coefficients were informally endorsed by the Beef Committee of the American Meat Institute as accurate and representative of industry yields. AMS has revised its cutout slightly as of January 1, 1988.

Appendix table 9--Retail mostly boneless beef cuts with one-fourth inch maximum outside fat as a percentage of Institutional Meat Purchase Specifications 100 series wholesale cuts for yield grade 2 and 3 carcasses

Retail cut	Ribeye	Brisket	Armbone chuck	Knuckle	Top (inside round	Bottom goose-neck	Strip loin bnls short cut	Top sirloin butt	Sirloin flap	Sirloin ball tip	Sirloin tri tip	Full tenderloin	Flank steak
	112A	120	126	167	168	170	180	184	185A	185B	185C	189	193
							Percent						
Subprimals as percentage of carcass 1/	3.39	2.73	23.73	2.87	5.82	7.26	3.91	3.39	0.49	0.54	0.69	0.47	0.45
Ribeye roast lip on bnls	48.26	---	---	---	---	---	---	---	---	---	---	---	---
Ribeye steak lip on bnls	48.70	---	---	---	---	---	---	---	---	---	---	---	---
Brisket roast point cut	---	49.35	---	---	---	---	---	---	---	---	---	---	---
Brisket roast flat cut	---	33.09	---	---	---	---	---	---	---	---	---	---	---
Shoulder pot roast bnls	---	---	9.93	---	---	---	---	---	---	---	---	---	---
Shoulder steak bnls	---	---	3.12	---	---	---	---	---	---	---	---	---	---
Top blade steak bnls	---	---	1.75	---	---	---	---	---	---	---	---	---	---
Underblade steak bnls	---	---	7.80	---	---	---	---	---	---	---	---	---	---
Chuck pot roast bnls	---	---	9.44	---	---	---	---	---	---	---	---	---	---
Chuck eye steak bnls	---	---	1.87	---	---	---	---	---	---	---	---	---	---
Chuck eye edge pot roast	---	---	3.52	---	---	---	---	---	---	---	---	---	---
Mock tender steak	---	---	3.29	---	---	---	---	---	---	---	---	---	---
Chuck short rib bnls	---	---	3.21	---	---	---	---	---	---	---	---	---	---
Chuck London broil	---	---	3.57	---	---	---	---	---	---	---	---	---	---
Shank crosscut bnls	---	---	3.13	---	---	---	---	---	---	---	---	---	---
Beef cube steak	---	---	5.00	10.34	6.14	2.15	---	5.94	---	---	---	---	---
Top blade pot roast bnls	---	---	2.28	---	---	---	---	---	---	---	---	---	---
Tip roast	---	---	---	47.39	---	---	---	---	---	---	---	---	---
Tip steak	---	---	---	29.73	---	---	---	---	---	---	---	---	---
Top round steak	---	---	---	---	44.83	---	---	---	---	---	---	---	---
Top round roast	---	---	---	---	29.79	---	---	---	---	---	---	---	---
Heel of round	---	---	---	---	---	14.27	---	---	---	---	---	---	---
Bottom round steak	---	---	---	---	---	28.55	---	---	---	---	---	---	---
Bottom round rump roast	---	---	---	---	---	14.19	---	---	---	---	---	---	---
Eye of round roast	---	---	---	---	---	11.17	---	---	---	---	---	---	---
Eye of round steak	---	---	---	---	---	8.23	---	---	---	---	---	---	---
Top loin steak bnls	---	---	---	---	---	---	72.44	---	---	---	---	---	---
Ball tip steak	---	---	---	---	---	---	---	---	---	64.36	---	---	---
Ball tip steak, thin	---	---	---	---	---	---	---	---	---	7.00	---	---	---
Ground beef No. 3 81/19	---	---	15.15	4.57	2.46	5.54	3.73	.95	24.19	15.68	2.95	2.99	---
Beef for stew	---	---	9.29	---	2.64	---	---	---	---	---	---	---	---
Beef cubes small	---	---	---	---	---	---	---	---	---	4.15	---	---	---
Cubes for kabobs	---	---	---	---	---	---	---	7.05	14.07	6.55	6.95	8.72	---
Flap meat strips	---	---	---	---	---	---	---	---	25.93	---	---	---	---
Sirloin strips regular	---	---	---	---	---	---	---	--	24.07	---	---	---	---
Sirloin strips thin	---	---	---	---	---	---	---	---	11.16	---	---	---	---
Top sirloin steak bnls	---	---	---	---	---	---	---	73.71	---	---	---	---	---
Tri tip roast	---	---	---	---	---	---	---	---	---	---	20.86	---	---
Tri tip steak	---	---	---	---	---	---	---	---	---	---	60.32	---	---
Tenderloin roast	---	---	---	---	---	---	---	---	---	---	---	31.13	---
Tenderloin steak	---	---	---	---	---	---	---	---	---	---	---	35.37	---
Tenderloin tips	---	---	---	---	---	---	---	---	---	---	---	4.23	---
Beef flank steak cubed	---	---	---	---	---	---	---	---	---	---	---	---	33.04
Flank steak rolls	---	---	---	---	---	---	---	---	---	---	---	---	31.98
Flank steak scored	---	---	---	---	---	---	---	---	---	---	---	---	34.45
Beef skirt steak bnls	---	---	---	---	---	---	---	---	---	---	---	---	---
Skirt steak bnls cubed	---	---	---	---	---	---	---	---	---	---	---	---	---
Beef strips thin	---	---	---	---	---	---	---	---	---	---	---	---	---
Lifter braise strip	---	---	---	---	---	---	---	---	---	---	---	---	---
Beef for stew (lean)	---	---	---	---	---	---	---	---	---	---	---	---	---
Other cuts	---	---	---	---	---	---	---	---	---	---	---	---	---
Fat	2.60	16.82	17.16	7.04	13.62	15.10	23.61	11.80	---	1.04	8.15	16.69	---
Bone	---	---	---	---	---	---	---	---	---	---	---	---	---
Shrink	.30	.37	.15	.46	.35	.42	.22	.32	.58	.97	.14	.50	.26
Cutting loss	.14	.37	.34	.47	.17	.38	---	.23	---	.25	.63	.37	.27
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

See footnotes at end of table.

Continued

Appendix table 9--Retail mostly boneless beef cuts with one-fourth inch maximum outside fat as a percentage of Institutional Meat Purchase Specifications 100 series wholesale cuts for yield grade 2 and 3 carcasses (Continued)

Retail cut	Sirloin ball tip 185B	Sirloin tri tip 185C	Full tender-loin 189A	Flank steak 193	Outside skirt	Inside skirt	Trimmings 50/50	Other cuts
				Percent				
Subprimals as percentage of carcass 1/	0.54	0.69	0.47	0.45	0.47	0.44	12.67	6.51
Ribeye roast lip on bnls	---	---	---	---	---	---	---	---
Ribeye steak lip on bnls	---	---	---	---	---	---	---	---
Brisket roast point cut	---	---	---	---	---	---	---	---
Brisket roast flat cut	---	---	---	---	---	---	---	---
Shoulder pot roast bnls	---	---	---	---	---	---	---	---
Shoulder steak bnls	---	---	---	---	---	---	---	---
Top blade steak bnls	---	---	---	---	---	---	---	---
Underblade steak bnls	---	---	---	---	---	---	---	---
Chuck pot roast bnls	---	---	---	---	---	---	---	---
Chuck eye steak bnls	---	---	---	---	---	---	---	---
Chuck eye edge pot roast	---	---	---	---	---	---	---	---
Mock tender steak	---	---	---	---	---	---	---	---
Chuck short rib bnls	---	---	---	---	---	---	---	---
Chuck London broil	---	---	---	---	---	---	---	---
Shank crosscut bnls	---	---	---	---	---	---	---	---
Beef cube steak	---	---	---	---	11.36	---	14.72	---
Top blade pot roast bnls	---	---	---	---	---	---	---	---
Tip roast	---	---	---	---	---	---	---	---
Tip steak	---	---	---	---	---	---	---	---
Top round steak	---	---	---	---	---	---	---	---
Top round roast	---	---	---	---	---	---	---	---
Heel of round	---	---	---	---	---	---	---	---
Bottom round steak	---	---	---	---	---	---	---	---
Bottom round rump roast	---	---	---	---	---	---	---	---
Eye of round roast	---	---	---	---	---	---	---	---
Eye of round steak	---	---	---	---	---	---	---	---
Top loin steak bnls	---	---	---	---	---	---	---	---
Ball tip steak	64.36	---	---	---	---	---	---	---
Ball tip steak, thin	7.00	---	---	---	---	---	---	---
Ground Beef No. 3 81/19	15.68	2.95	2.99	---	9.83	10.88	32.92	---
Beef for stew	---	---	---	---	---	---	---	---
Beef cubes small	4.15	---	---	---	---	---	4.26	---
Cubes for kabobs	6.55	6.95	8.72	---	---	---	12.94	---
Flap meat strips	---	---	---	---	---	---	---	---
Sirloin strips regular	---	---	---	---	---	---	---	---
Sirloin strips thin	---	---	---	---	---	---	---	---
Top sirloin steak bnls	---	---	---	---	---	---	---	---
Tri tip roast	---	20.86	----	---	---	---	---	---
Tri tip steak	---	60.32	---	---	---	---	---	---
Tenderloin roast	---	---	31.13	---	---	---	---	---
Tenderloin steak	---	---	35.37	---	---	---	---	---
Tenderloin tips	---	---	4.23	---	---	---	---	---
Beef flank steak cubed	---	---	---	33.04	---	---	---	---
Flank steak rolls	---	---	---	31.98	---	---	---	---
Flank steak scored	---	---	---	34.45	---	---	---	---
Beef skirt steak bnls	---	---	---	---	41.45	63.46	---	---
Skirt steak bnls cubed	---	---	---	---	15.54	---	---	---
Beef strips thin	---	---	---	---	15.63	---	6.44	---
Lifter braise strip	---	---	---	---	---	---	10.40	---
Beef for stew (lean)	---	---	---	---	---	---	16.43	---
Other cuts	---	---	---	---	---	---	---	87.10
Fat	1.04	8.15	16.69	---	5.74	25.39	---	12.00
Bone	---	---	---	---	---	---	---	---
Shrink	.97	.14	.50	.26	.32	.18	1.71	.65
Cutting loss	.25	.63	.37	.27	.13	.09	.18	.25
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Components removed when carcass is fabricated into wholesale cuts:								
Wholesale cuts	77.40							
Fat (break)	8.05							
Bone (break)	13.98							
Loss (break)	.57							
Total	100.00							

--- = Not applicable.
Bnls = boneless.

1/ This subprimal row lists the percentage each primal is of the carcass. The other rows indicate how that subprimal is divided into cuts, fat, shrink, and loss.

Sources: Agricultural Marketing Service for carcass to wholesale cuts; large U.S. beef packer and processor for wholesale to retail.

Industry Retail Cut Data

In order to convert wholesale yield to retail yield, we used data supplied by industry sources. The conversion factor examined applies to retail cuts; the AMS-fabricated cut series and the yields used in earlier stages of this analysis apply only to wholesale cuts. A major packer supplied us with primal- and subprimal-to-retail cut yields for a number of wholesale cuts.

We prepared appendix tables 8 and 9 by selecting wholesale cuts that matched the AMS cuts. Note that the first step (to wholesale cuts) gave a yield of 77.4 percent and the second step 87.1 percent. The combination of these two takes the yield from carcass to retail cuts (0.774 x 0.871 = 0.674). In this case, the retail cuts are all boneless and have a maximum of one-fourth inch fat cover. This combined test reflects Choice yield grade 2 or 3 cattle. The difference between 67.4 percent (77.4 minus fat, bone, and loss from cutting to retail) and 74 percent is the 3-4 percent of bone included in the 0.74 value and the additional 3-4 percent of fat trimmed from the retail cuts.

This estimate of 67.4 (appendix table 8) is consistent with the value found on p. 17 of the ESCS statistical bulletin. The bulletin's estimate was slightly higher at 69.8 percent, but the fat trim (of the 69.8) is up to one-half rather than one-fourth inch.

The estimate shown in appendix table 8 is also consistent with the Clay Center ARS data. This 67 to 68 percent could be viewed as a minimum to which the conversion factor we are examining could fall for yield grades 2 and 3 steers and heifers if all cuts were boneless and trimmed to one-fourth inch outside fat. The overall average figure would be higher (better yield), because it would include data for cows and bulls. (73.3 and 75.3 percent respectively). Cows and bulls are always deboned, and their fat percentage is already smaller than what is normally used in ground beef.

Yields for Cows, Bulls, and Stags

We obtained cutting yield data by type of cows. We also obtained secondary data on cow yields from two packers. The cuts saved from cows vary by grade, type of cattle, fatness of cows, and particular practices of the packer. Cows are, however, almost always completely boned out. Bulls and stags are also completely boned out. In addition, the bulls and stags have a different ratio of fat to muscle and bone, making their yield higher than cow yields.

We looked at the percentage of Canner and Cutter grade cows versus Utility cattle for boning and breaking based on information from packers. Canners and Cutters are about 70-75 percent of all Utility, Canner, and Cutter cattle. Utility cattle provide a little higher boneless yield. Although fatter cows yield a little higher, the fat content of the meat is higher which means a lower price for the meat trimmings. If trimmings are higher in fat, it will take more to reduce the average fat content of ground beef made from the trimmings.

Yields of cows, bulls, and stags have remained essentially the same over time. Fed steer and heifer yields have changed and the fat left on retail cuts from fed steers and heifers has changed, but these changes have not affected cows, bulls, and stags.

We decided to use the 73.3 percent (listed in the ESCS bulletin for Canner and Cutter) for the cow yield because this published number seems to reflect the weighted average of all cows over time. We assumed that bulls and stags yield 2 percent higher based on industry sources. We then assumed that these estimated yields (73.3 for cows and 75.3 for bulls and stags) remained the same during the entire study period.

Adjusting for Fat Trim Below One-Half Inch

AMS standards assume that one-half inch of fat is left on the final retail cut of beef. We used this guide in the first step of the Conversion Factor Adjusting method. After examining other sources of data on actual cutting practices, we reached a conclusion about how much we must adjust the AMS standard to account for retailers or packers trimming away fat below the half-inch level.

Texas A&M University Study

An ongoing study at Texas A&M University (funded mainly by the National Livestock and Meat Board and the California Beef Council) is looking at retail yield differences from various fat trimness levels. The current emphasis on closer fat trim makes these comparisons especially important to this conversion factor study.

For each method of breaking the carcass that produces the subprimal and cut breakout used by AMS in its fabricated cut composite series, Texas A&M University obtained trimmable fat levels indicated in appendix table 10. Note that these trim levels reflect removal of only outside fat on these subprimals. Seam fat still remains inside these cuts, which will be trimmed when retailers cut the meat. This will be reported in later work by Texas A&M University. When completed, this study should provide valuable information regarding fat removal at various trim levels.

Appendix table 10--Trimmable fat generated when trimness levels are reduced from 1 inch to one-half inch to one-fourth inch 1/

Fat	Choice yield grade 3	Choice yield grade 2	Choice yield grade 1
		Percent	
1 inch	7.88	7.03	6.17
One-half inch	9.39	7.90	7.30
One-fourth inch	11.20	9.44	9.18

1/ Trimmable fat does not include seam fat.

Source: J.W. Savell, D.B. Griffin, and H.R. Cross. "Determining Cutability of Beef Carcasses Using Multiple Subprimal Endpoints and Various Trimness Levels," unpublished study, College Station, TX: Texas A&M University Department of Animal Science, 1986.

Industry Sources

The change in yield when retailers start cutting to only one-fourth inch of fat depends on how closely they were trimming before. One industry source felt that trimming to one-fourth inch made only a 1.4 to 1.6 percentage point difference in yield because retailers were already trimming close. Retailers provided estimates from 1.7 percent to 5.9 percent more fat trim when moving to the one-fourth inch standard.

For this conversion factor study, we chose to use the USDA-AMS standard yield grade cutouts. AMS used a one-half inch standard for fat trim. The effect of trimming from one-half to one-fourth inch is based on packer-supplied data. Assumptions used are provided in appendix table 8.

Fat in Ground and Processed Beef

The procedure used to derive the conversion factor accounted for 6 percentage points less fat in ground and processed beef in 1988 compared with 1975. Various fat limits are set for different products, and the trim from various animals and parts of the carcass must be combined to meet specifications. Ground beef must have at least 70 percent lean to pass Federal requirements. A few States require a larger percentage. The fat content allowed in processed products varies by product, but for most, a maximum of 30 percent fat is allowed.

If a product can be sold at a given price, the seller gains an advantage by including as much fat as possible because fat is a low-cost ingredient. However, in recent years, packers and retailers have felt consumer demand for products with lower fat. Packers and retailers have responded with lower fat ground beef and processed products.

Data are not available to accurately indicate the average percentage of fat sold in ground and processed beef. We estimated the change in this percentage over time. We assumed the percentage of fat dropped by 1 percentage point by 1985 and allowed the drop from 0 to 1 to occur over 10 years. We decreased the fat content again in 1986 and 1987, but not in 1988. The 1987 number is 6 percentage points below the beginning 1975 value.

Beef Not Federally Inspected

To calculate this adjustment, we used table 13 on page 12 of MRR 1073, Grades of Fed Beef Carcasses 6/, to find that the average yield grade changed by 0.3 between weight group 500-599 pounds and 600-699 pounds. The average yield difference between standard yield grades is 4.6 percent (appendix table 3). Thus, 100 pounds additional weight would change the cutout 0.3 x 4.6, or 1.38 percent.

To determine the poundage difference between Federally Inspected (FI) and non-FI, we used the carcass weight per head of FI, other, and farm slaughter. We divided the carcass weight of other and farm into the total slaughter weights of each to obtain the number of head slaughtered of each. Add the two head estimates and the total weights. Division of the total pounds by the

6/ U.S. Department of Agriculture, Agricultural Marketing Service. Grades of Fed Beef Carcasses: November 1973-October 1974, MRR No. 1073, July 1977.

total number of head gives the average carcass weight of all non-FI cattle. This number subtracted from the average FI carcass weight tells the difference between FI and non-FI carcass weights. The difference divided by 100 is then multiplied by the 1.38 obtained earlier.

A ratio of FI pounds over the total production gives the percentage of slaughter that was FI. One hundred minus this number gives the percentage of non-FI slaughter. The percentage of non-FI slaughter is then multiplied by the change in cutout (last paragraph), and the weight adjustment for non-FI slaughter is complete. It is added to the conversion factors obtained in step 10 of the Conversion Factor Adjusting method.

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